

## Well Installation Board News

The Well Installation Board held its quarterly meeting February 15, 2016, in conjunction with the Missouri Water Well Association's annual convention at Tan-Tar-A Resort located in Osage Beach. The Board received updates on program and section activities, rule development, proposed legislation and changes to the Special Area 2 map. Staff presented an overview of the new online test for restricted and apprentice permits.

The next quarterly meeting is scheduled for 10 a.m. May 20, 2016, in the Mozarkite Conference Room at the Department of Natural Resources' Missouri Geological Survey, Annex Building, 1251 Gale Drive, Rolla.

## Staff News

### Amber Steele Joins the Wellhead Protection Section



Amber Steele accepted a position as an Environmental Specialist in the Wellhead Protection Section and began work on April 11, 2016. A Missouri native, Steele holds an undergraduate degree in Geology and Environmental Science from Southeast Missouri State University and a master's degree in Soil Science from the

University of Missouri. In her previous position with the state of Minnesota, she held the title of Wetland Specialist where she oversaw the implementation of the Wetland Conservation Act. She is a former department employee working as a Soil Scientist and Environmental Specialist in Jefferson City. Amber will assist with rule development, enforcement activities, case work and other field-related activities.

## Online Permit Testing

The Wellhead Protection Section, in conjunction with the Information Technology Services Division, developed an online testing application for restricted permits for pump, water, monitoring and heat pump well installation contractors. The project began in May 2015 and went live in October 2015. Online permit testing is available at [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells). Applicants must complete the Contractor and Apprentice Testing Application, Form 780-1424, <http://dnr.mo.gov/forms/780-1424-f.pdf> and submit it to the section to obtain a test ID. Once the test ID is provided, proceed to the test site at the link provided above. An applicant can pay for the test online or make payment to the section prior to taking the exam. An applicant will have 24 hours to complete an exam. The online test will benefit the regulated community by eliminating the need to come to Rolla to take the test, which is offered only once a month. The automated test will save staff time and increase efficiency in state government.

## Monitoring Well Drill Logs

Monitoring well contractors now have the ability to upload documents such as drilling logs when records are submitted online. Visit [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells) to access the department's online services. When you reach the formation description entry screen, you may upload the drilling log instead of entering the formation description. The option to upload a drilling log for other wells types will be available in the coming months.

## The McNairy Aquifer of Southeast Missouri

The McNairy Formation is one of only two Cretaceous units in Missouri, the other being the Owl Creek Formation. The Cretaceous units crop out along the northern reaches of Crowley's Ridge and also in the Benton Hills of southeast Missouri (Figure 1). Isolated occurrences also are found up to 20 miles north and west of the Ozark Escarpment.

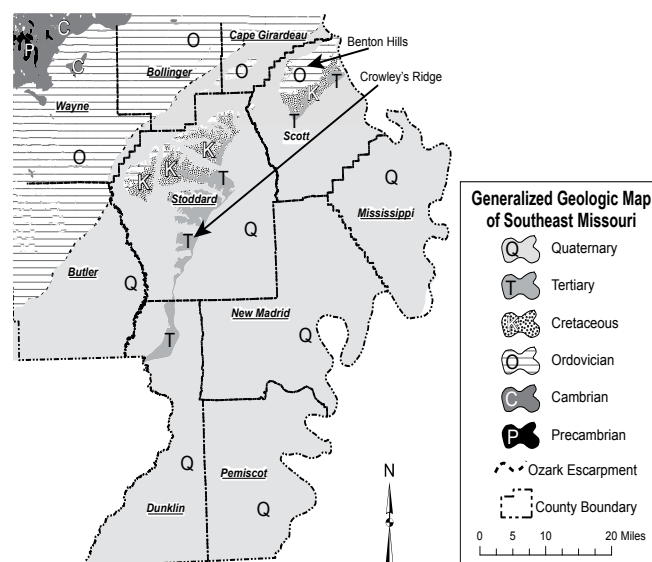


Figure 1. Generalized Geologic Map.

The McNairy is named after the county in Tennessee where the non-marine extension of the marine Ripley Formation of Mississippi was described. The McNairy Formation in Missouri formerly was divided into two members, the Commerce Member below with the overlying Ardeola Member.<sup>4</sup> The member designations have since been dropped, but still can be seen in outcrops. The lower part (Commerce) contains (in ascending order): A basal gravel; a thin-bedded, light-gray clay, interbedded with thin layers of fine- to medium-grained orange sand; and a sandstone composed of light-yellow to orange, medium- to coarse-grained subangular sand with little or no mica. This upper sandstone is often very well silicified and is locally named the Commerce quartzite.<sup>5</sup>

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The upper part of the McNairy (Ardeola) is composed of a succession of five alternating beds of sandstone and clay. They are (in ascending order): A yellow to brown, clayey sandstone; a white to yellow, fine-grained, micaceous sandstone; a light-gray to brownish-black, lignitic clay; an interbedded, orange sandstone and gray to brown clay; and a brown, lignitic, sandy clay<sup>5</sup>.

In the Bootheel region, the McNairy Formation has an approximate bedding strike of N 60° E with a 0.4° dip southeast. Attitude of the formation was determined by relating three well logs intercepting the top of the McNairy, one each in Stoddard, Mississippi and Pemiscot counties. A north-south cross section (Figure 2) depicts the orientation of the McNairy and its relationship to other geologic units.<sup>2</sup>

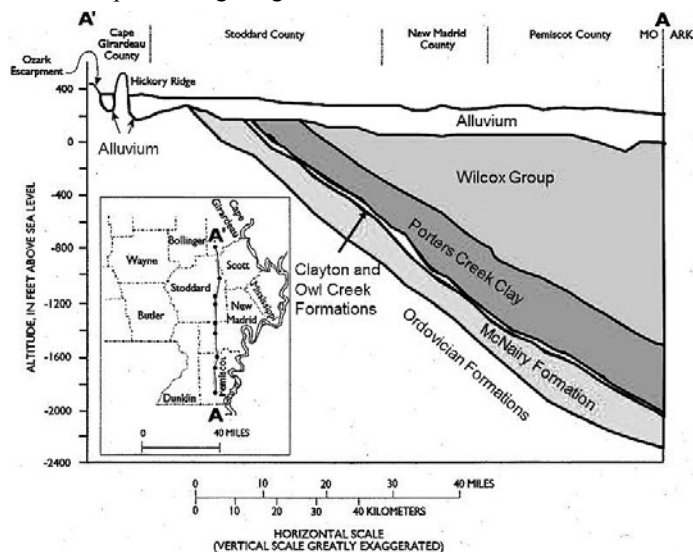


Figure 2. Southeast Missouri Geologic Cross Section.<sup>2</sup>

The McNairy Aquifer (also known as the Ripley Sand) is composed completely of the McNairy Formation and is a significant source of groundwater in the Bootheel region of Missouri. This aquifer underlies about 3,328 square miles in this region and is used widely as a source of drinking water mainly because of two factors. First, the McNairy is under considerable artesian pressure. The high static water levels in the wells penetrating the McNairy decrease cost for well construction by reducing both the depth pumps must be set as well as the size of pump that must be installed. Because the pumps are set at shallower depths, the pump size required to pump water to the surface can be reduced. Secondly, the McNairy typically yields very soft water that contains little dissolved calcium, magnesium and iron. Water from the shallower aquifers usually requires treatment for iron and manganese removal. The depths of wells producing from the McNairy vary greatly from less than 200 feet near the outcrop area to more than 2,000 feet in southern Dunklin and Pemiscot counties.<sup>3</sup>

Yields of wells penetrating the McNairy vary somewhat, but generally range between 150 and 750 gpm. Yields are lowest on

and along Crowley's Ridge where the unit is relatively thin, and also in other places where the McNairy may be thick but where interbedded clay greatly decreases the total thickness of clean, permeable sand. The direction of groundwater movement in the McNairy is generally down dip to the southeast.<sup>3</sup>

The quality of water from the McNairy varies with location and proximity to recharge sources. The McNairy likely receives recharge from three principal sources: Precipitation falling on the McNairy where it crops out on Crowley's Ridge and Benton Hills; infiltration from streams where they flow directly across the McNairy; and recharge from the overlying alluvium west of Crowley's Ridge where the unit is overlain directly by alluvial materials. Probably very little recharge to the McNairy is from either the alluvium or Wilcox Group east and south of Crowley's Ridge. In these areas, the McNairy is overlain by thick Porters

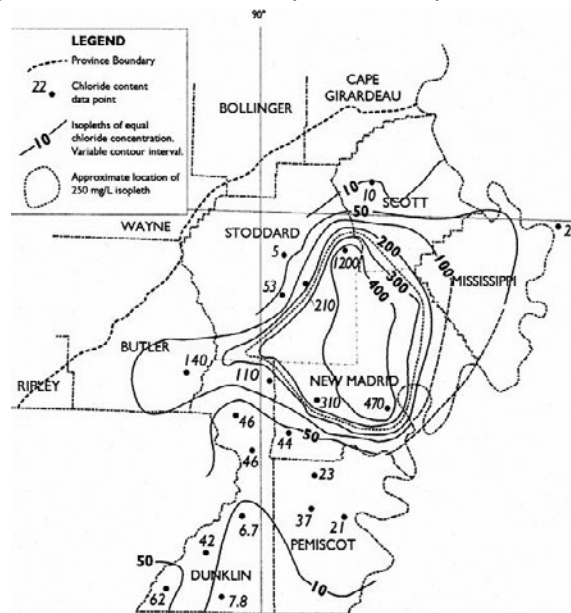


Figure 3. Chloride content (mg/L) in the McNairy.

Creek Clay, which has very low hydraulic conductivity. The Porters Creek, combined with the Clayton and Owl Creek formations, form a very effective aquiclude separating shallower groundwater from the McNairy water.<sup>3</sup> Water quality in the McNairy is poorest in a roughly circular area covering eastern Stoddard, southern Scott, southwestern Mississippi, and much of New Madrid counties<sup>1</sup> (Figure 3). Here, total dissolved solids and chloride concentrations in the McNairy generally exceed public drinking water standards. The reason for the poor water quality in this area is not entirely clear, but may be due to faulting, which has allowed saline water from deeper Paleozoic units to move upward into the McNairy.<sup>2</sup> Although the McNairy underlies an area containing about 3,328 square miles, the area of the aquifer containing water with less than 250 mg/L chloride is about 2,701 square miles. The volume of potable water stored in the McNairy Aquifer is estimated to be about 12 trillion gallons, or about 37 million acre-ft.<sup>3</sup>

#### REFERENCES:

- <sup>1</sup>Brahana, J.V. and Mesko, T.O., 1988, Hydrogeology and Preliminary Assessment of Regional Flow in the Upper Cretaceous and Adjacent Aquifers in the Northern Mississippi Embayment: U.S. Geological Survey, Water Resources Investigations Report 87-4000, 65 p.
- <sup>2</sup>Luckey, R.R. and Fuller, D.L., 1985, Water Resources of the Southeast Lowlands, Missouri: U.S. Geological Survey, Water Resources Investigations Report 84-4277, 78 p.

<sup>3</sup>Miller, D.E. and Vandike, J.E., 1997, Groundwater Resources of Missouri: Missouri Department of Natural Resources' Division of Geology and Land Survey, Water Resources-46, 210 p., 77 figs., 17 tbls.

<sup>4</sup>Stewart, D.R. 1942, Mesozoic and Cenozoic Geology of Southeast Missouri: Missouri Department of Natural Resources' Missouri Geological Survey, unpublished manuscript 40754, 24 p.

<sup>5</sup>Thompson, T.L., 1995, Stratigraphic Succession of Missouri: Missouri Department of Natural Resources' Division of Geology and Land Survey, Volume 40 (2nd Series) Revised, 188 p., 42, figs., and 1 tbl.

## Variance Updates

Questions have arisen as to whether a variance issued for work on a particular site would be valid for future work on the same site. Since variances are granted to allow for deviation from regulations, it is necessary to contact the section to update the associated information and to make revisions to an existing variance. Otherwise, the submitted record may not reflect a contractor's compliance with Missouri's Well Construction Rules.

Since internal policies change, this may affect how Wellhead Protection staff members respond to a specific variance request even though a similar variance may already exist for the same site. Timely contact with staff to revise an existing or issue a new variance will help save public resources, avoid inconvenience and possibly avoid expensive well reconstructions.

## Prenotification for Heat Pump Systems

Amendments to the heat pump rule were approved by the Well Installation Board and became effective January 1, 2014. Prenotification is required for any heat pump well using 5-foot grout plugs every 40 feet. Heat pump wells that are grouted full length are not required to prenotify. Prenotification must be completed 48 hours prior to installation of the heat pump system. The 48-hour notice may be submitted by email, fax, phone message, and mail, in person or by using the online notification form at [dnr.mo.gov/forms/780-2167.htm](http://dnr.mo.gov/forms/780-2167.htm). Notification will require the owner name and address, GPS location, date work is to begin, primary contractor name and permit number and drilling contractor name and permit number. We recommend prenotification take place when the required Missouri One Call (DIG-RITE) notification is made. It only takes a few minutes. Coordination or approvals are not needed from the department; just provide notification and, after 48 hours, begin working. Staff members are making periodic site visits to witness the installation of grout plugs.

## Local Restrictions for Residential Water Wells

A quick reminder: County, city and other regulated communities may have stricter laws and regulations concerning the drilling and location of wells within their jurisdictions. The department recommends checking with county, city and other local offices for any drilling restrictions or applicable ordinances prior to installing wells.

## Welcome Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted contractor community:

Aqua Services LLC – Allen Breuer  
ATC Group Service – Garrett Westland  
Geosyntec – Edward Jones  
Robinson Mechanical – Robert Lorey

## Welcome Apprentice Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted apprentice contractor community:

Aqua Wells Inc. – Anthony Parks  
Brown Well Drilling – Amy Nichols  
Environmental Works – Ryan Harris  
Jesse Yoakum Well Drlg – Matthew Yoakum  
McCray's Welding – Mason Horstman

## Farewell

The people addressed below are no longer permitted to operate as contractors according to the Water Well Drillers Act and Missouri Well Construction Regulations:

Aqua Wells – James Mallonee  
Atkisson Pump – James Baslee  
B & H Well Drlg – Jesse Borgmeyer  
Bindner, Lori  
Black & Veatch – Brian Ortega  
Booth Heating & Air – Brian Keith Bauer  
Bradburne Briller & Johnson – Amber Cicotte  
Braun Intertec – Joel Partridge  
Burge Irrigation – Zach Clubb  
Burns & McDonnell – Jordan Maddox  
Carthage Pump Supply – Ricky Roberts  
Connelly Plumbing – Brian Sothern  
Drill It Well – Brent George  
Environmental Science & Claim – Roger Sense  
Geotechnology – Brian Fingers  
Geotherm Drilling – Wade Hanks  
Gilbane Federal – David Bowers  
Haley & Aldrich Inc. – Ana Mora  
Hampton Pump Service – Kyle Hays  
HR Green Inc. – Adam Fisher  
Industrial & Petroleum Env – Jacob Miller  
Jackson Geothermal – Gary Sprowls  
John Meade Plumbing – John Meade  
Kennedy/Jenks Consultants – Martha Griffith, Joshua Sales  
Kaw Valley Engineering – Richard Leeds  
Kenworthy, Meredith  
Leggette Brashears & Graham Inc. – Cassandra Puletapuai  
Mid-America Environmental – David Greathouse  
MoDNR – Alan Reinkemeyer  
Mundell & Associates – Mark Breting  
Murphy, Robert  
Natural Resource Tech – Jacob Walczak, Troy Clausen, Patrick Hoefle  
Natures Rain – Charles Fletcher  
Ozark Professional Energy – Ken Hurley  
Riverfront Environmental – Craig Cox  
Roberts Environmental – Shawn Seymour  
Roux Associates – Timothy Adams  
S & L Irrigation – Alan Sollis  
Schroepfer Well Drilling – Ray Wilson  
Scott & Sons Drilling – Michael Harris  
Shannon & Wilson – Patricia Nichols  
Stantec Consulting – Andrew Riemer  
Superior Environmental – Kira Stevens  
The Doe Run Company – Charles Seabourne Jr  
Vironex – Sean Gardner  
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